This public information document is focused on providing critical information about rotenone use for fish conservation, and has been prepared specifically for Westslope Cutthroat Trout restoration in the Pend Oreille Basin. The information is not exhaustive. For additional information see the links provided below.

Westslope Cutthroat Trout Conservation in the Pend Oreille Basin:
Non-Native Fish Removal Options and Rotenone Safety
Public Information Sheet II: February 2, 2017

Why do we need to remove non-native fish in order to conserve native species?
Native Westslope Cutthroat Trout (WCT) have been declining throughout their historic range. In the Pend Oreille Basin, WCT historically occupied over 99% of tributary streams. Today, WCT are present in only 35% of these streams. To protect against further decline, WCT were petitioned to be listed as threatened under the Endangered Species Act in 1998. Following a status review, it was determined that an ESA listing was unwarranted. Status of WCT was reconsidered in 2003, and ESA listing was again deemed unwarranted. WCT populations continue to face threats posed by non-native fish species including competition for resources, predation, and interbreeding. Removal of non-native fish species from areas within the Pend Oreille Basin prioritized for native fish conservation increases the likelihood of long-term WCT persistence. Restoration of local WCT populations will contribute to conservation of WCT by increasing distribution and abundance within the historical range, thus reducing the risk of a future ESA listing.

Why is rotenone application the preferred method for removal of non-native fish?
Widely used in the United States as a conservation tool, rotenone (pesticide for fish) applications have been demonstrated to be a cost-effective and very low-risk fish removal technique. Rotenone is one of the piscicides approved by the EPA for use in streams, and it has been used safely and successfully both locally and worldwide. Alternative methods of fish removal include electrofishing, netting, dewatering, and traditional angling techniques. These methods can be expensive, difficult or impractical, and with the exception of dewatering, largely ineffective at completely removing fish populations from a stream. See the additional links below for more information on alternative removal options.

What is rotenone?
Rotenone is a naturally occurring substance found in the roots of several varieties of bean plants (Leguminosae family) and has long been used by indigenous people for fishing purposes. The plant roots are dried and processed into either a powder that is used as a piscicide in standing water or formulated as a liquid for use in flowing systems.

How and when is rotenone applied?
Rotenone is available in liquid and powder form. The most common method for stream application is dispersal of liquid rotenone from drip cans that are calibrated to discharge a predetermined amount of liquid rotenone based on the amount of water flowing in the stream. Drip cans are often used in combination with backpack sprayers and a powdered rotenone-gelatin-sand mixture to treat pools of standing water. Rotenone may be applied at any time of the year, but most applications typically occur during warm months (such as summer/early fall) because low water levels and warm temperatures reduce the amount of piscicide required to be effective.

What concentration of rotenone would be used for removal of non-native fish in the Pend Oreille Basin?
The rotenone label allows for treatment concentrations up to 4 parts per million (ppm). For applications to streams in Pend Oreille Basin where target non-native species are salmonids such as trout and char, application concentrations of rotenone will typically range from 0.5-2.0 ppm. During the Cee Cee Ah Creek pilot project in 2008, for example, rotenone concentrations never exceeded 1.0 ppm.

How does rotenone affect aquatic animals?
Rotenone is selectively toxic to gill breathing animals. Fish are the most sensitive, followed by aquatic invertebrates and gill breathing forms of amphibians. Reductions in aquatic invertebrates and amphibians are temporary, as studies have shown that invertebrates and amphibians will repopulate the treatment area after rotenone breaks down.

Does rotenone affect all animals the same?
No, rotenone is highly toxic to gill breathing animals because gills allow it to be absorbed directly into the blood stream. The primary pathway for entry into the body for birds and mammals is ingestion. Birds and mammals that eat dead fish and drink treated water are not affected because natural enzymes in the digestive tract neutralize rotenone. A bird weighing 0.25 lb would need to consume 25 gallons of treated water in one sitting to receive a lethal dose. In addition, rotenone does not concentrate in fish tissue and is quickly broken down in the environment. Altogether, these factors equate to minimal risk to humans, mammals, and birds..

Is rotenone an immediate risk to human health?
No. At the maximum allowable treatment concentration (4 ppm), a 160 lb person would have to drink more than 23,000 gallons of treated water at one sitting to receive a lethal dose.

Is rotenone a long-term risk to human health?
Rotenone is not considered by the U.S. EPA to be a carcinogen (capable of causing cancer), mutagen (capable of causing genetic mutation), teratogen (capable of interfering with normal embryonic development), or reproductive toxin (capable of affecting reproduction). The EPA lists a safe level for rotenone in drinking water of 0.8 ppm and a safe level for water contact (e.g. swimming) of 1.8 ppm. These safe levels assume a worst-case, lifetime exposure to rotenone. In other words, a person would need to be exposed for their entire life for negative effects to develop. Because rotenone breaks down quickly in the environment and because of safety procedures used in the application, there is absolutely no long-term exposure risk during a typical treatment. As additional precautionary measures, trained personnel wear appropriate personal protective equipment, and the public is always excluded from treatment areas until rotenone residues have dissipated.

What procedures are in place to ensure safe and effective use of rotenone?
Project supervisors and applicators are professionally trained and licensed to conduct aquatic piscicide applications. To ensure project success and safety for the public, applicators, livestock and the environment all EPA-approved product labels and instructions are followed. A significant amount of preparation and data collection takes place prior to implementing all

rotenone applications. This data ensures effective project design, application, and safety protocols. All entry points and shorelines along the treatment area are posted with information regarding the project and re-entry. Contact is made with landowners and regular land users (e.g., livestock owners) to ensure that they are aware of the project and any precautions they need to take during the treatment. Rotenone is deactivated immediately below the treatment area using potassium permanganate (used worldwide in water purification) to ensure water and fish remain unaffected downstream. Trained and certified personnel stay on site until rotenone is no longer detected in the area.

What happens to rotenone after it is applied to the water?
Rotenone breaks down rapidly in the environment once exposed to oxygen, sunlight, and organic material. Increases in temperature or sunlight increase the breakdown rate of rotenone.

How long does rotenone persist in water and sediment?
Numerous monitoring projects have shown that rotenone residues typically disappear within about one week to one month, depending on environmental conditions. The half-life (time required for ½ of the material to break-down) of rotenone varies from about 12 hours to 7.5 days, and is inversely related to temperature. Rotenone is typically applied when water temperatures are warm to optimize effect on the fish and the breakdown rate in the environment. As an added measure of control, potassium permanganate is applied to deactivate rotenone immediately below the treatment area.

How is rotenone prevented from leaving the treatment area and killing fish downstream?
Project personnel apply potassium permanganate to deactivate rotenone. Potassium permanganate, used worldwide to purify drinking water, is applied to the stream at the point where the effects of rotenone are no longer desired.

Are there dangers of contaminating ground water?
No. Rotenone is highly insoluble in water and strongly binds to soil particles in bottom sediments and to suspended particles in the water column. It typically penetrates no deeper than 1 inch into the sediment of a lake or river bottom. As a result, it poses virtually no chance of contaminating groundwater.

When can the public access the water after treatment?
The public is not allowed in contact with the treated water until rotenone residues have dissipated below 1.8 ppm. The EPA minimizes risks of exposure for swimmers during rotenone treatments by requiring area closures (and swimming prohibition) post-treatment until levels are safe for swimming and/or consumption per EPA guidelines. Project personnel will post notices at all entry points to the site to ensure that the public is aware, and that contact does not occur.

Can rotenone-treated water be used for irrigation of crops?
Research has not shown any health hazards from using water containing rotenone. However as an additional precaution, water containing residues of rotenone cannot be used on crops. This does not mean that doing this is actually unsafe, but that no allowable levels have been established.

What safeguards are in place to protect citizens and property?
Personnel licensed by the Washington State Department of Agriculture to apply aquatic pesticides manage all rotenone-related fish conservation efforts in the Pend Oreille Basin. Additionally, personnel will follow all best practices established in the SDS (safety data sheet) and EPA-approved product labels. Staff will also be guided by experience gained through the many other past rotenone application projects throughout the state.

Are there dangers from consuming fish from rotenone treated water?
Fish killed by rotenone should not be consumed by humans due to the risk of possible salmonella and other bacteriological poisoning that can occur from consuming fish that have been dead for a period of time. The rotenone residues in dead fish carcasses are quickly broken down by physical and biological reactions.

What is the impact on wildlife and the loss of food supply of fish?
During rotenone treatments, fish-eating birds and mammals may be found foraging on dying and recently dead fish after treatment. A temporary reduction in forage will occur until fish and invertebrates have been restored. However, most of the affected individuals are mobile and will seek alternate forage.

Where can I find additional information?
Links to additional information are provided below

http://wdfw.wa.gov/licensing/sepa/2010/10064_ceecee.pdf (More information about the Cee Cee Ah Creek pilot project from WDFW)
http://www.fisheriessociety.org/rotenone/EradicatingIASFishNA.pdf (Overview of fish conservation using rotenone and detailed answers to common questions about its use and utility in fish conservation)
http://www.epa.gov/oppsrrd1/reregistration/REDs/rotenone_red.pdf (Technical information about the EPA approval of rotenone as a piscicide)
http://www.azgfd.gov/h_f/documents/ROTENONE%20FAQ%20committee%20final%20report%20section%201-6-12.pdf (Maintaining North America's Healthy Native Aquatic Ecosystems" by the American Fisheries Society on invasive species management.)